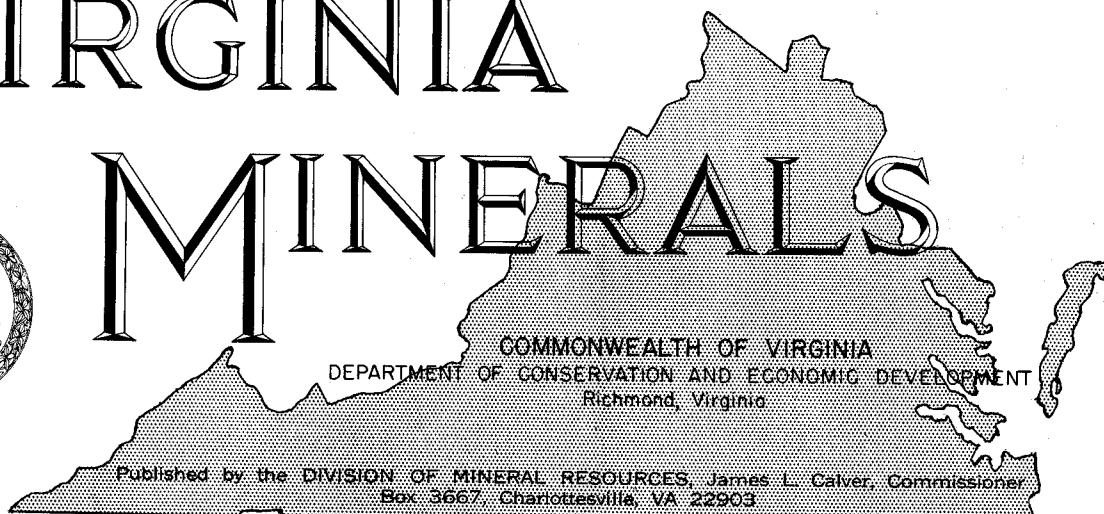


VIRGINIA



MINERALS



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RECLAMATION OF DEPLETED SAND AND GRAVEL SITES IN EASTERN VIRGINIA

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Sand and gravel are basic construction materials necessary to build the homes, offices, factories, highways, and other facilities required by our society. The production of sand and gravel in the United States constitutes the largest volume of any raw mineral commodity produced. In 1965, as reported by the United States Bureau of Mines, 908.1 million tons of sand and gravel were produced at a value of \$957.4 million. In volume the production of crushed stone, of which 777.7 million tons were produced in 1965, was the closest competing commodity. In value sand and gravel were exceeded only by cement, crushed stone, and fuels. Thus, it becomes apparent that as a building material sand and gravel rank among our most important mineral commodities, and that reserves are an asset to the resources of a community.

Sand and gravel are usually produced by surface-mining methods that employ power shovels, draglines, and dredges. The raw materials are excavated on or near the surface, resulting in a lowering of the land contours or in the creation of pits that may become water filled. The materials produced are usually washed and classified in a plant at or near the extraction site, and are used directly or stockpiled for use as needed.

Because sand and gravel are low-value and bulky commodities, they are costly to transport; and it is important for producers to seek deposits close to a market. Producers, however, are being forced, by the very construction that makes their existence possible, to move operations increasingly farther from the primary market, the metropolitan area. The increased transportation costs, while borne initially by the sand and gravel producers, are inevitably reflected in higher construction costs in the community. This condition illustrates the necessity for the sand and gravel producers and community leaders to thoroughly understand one another's problems. The time is past when producers can afford to remain apart from local planning. Likewise, planning officials must understand the importance of recognizing and making available the sand and gravel resources in or near the cities. They should understand the benefits that can be received by a locality when fair and proper guidelines have been established for producers to follow. Professional planners take many variables into consideration in order to establish a working plan for the sand and gravel producers and community development. A plan that may work well for one area may not be applicable to another; the economic, legal, geologic, and social factors vary from one locality to another.

In late 1965 and early 1966, an inquiry was made of 12 city and county governments in east-

¹ Manuscript completed August 31, 1966, while Mr. Pharr was a staff member of the Virginia Division of Mineral Resources; his present address is: Nordberg Manufacturing Co., Atlanta, Georgia.

ern Virginia to learn of ordinances used to control the mining or production of sand, gravel, rock, or mineral materials. The canvass was limited to areas of major production or consumption of sand and gravel in eastern Virginia, and included Chesterfield, Fairfax, Henrico, Prince George, and Stafford counties and the cities of Chesapeake, Colonial Heights, Hampton, Newport News, Norfolk, Richmond, and Virginia Beach. All of the localities canvassed, except the city of Norfolk, allow the mining of sand and gravel, and all of the localities that allow mining, except the city of Colonial Heights, have enacted or proposed laws that control such mining to some degree. These ordinances govern aspects of zoning, excavation, and restoration and differ considerably from locality to locality.

In most cases, ordinances restrict the mining of sand and gravel to certain zoned areas. In Richmond, the extraction of raw materials may be allowed "by exception" by the Board of Zoning Appeals. Special renewable permits are required during extraction and until a sand and gravel deposit is depleted or abandoned in Chesterfield, Fairfax, Henrico, and Prince George counties and in Chesapeake, Hampton, Newport News, and Virginia Beach. The length of time for which permits are issued was found in most localities to be at the discretion of the city, or of the county Board of Supervisors. Only Fairfax County specifies the length of time for which such a permit is issued. Chesterfield, Fairfax, Henrico, and Prince George counties stipulate that permits must be renewed after designated periods of inactivity at a site. The ordinances of Chesterfield, Henrico, and Prince George counties specify that if on-site mining operations are abandoned for any period exceeding 12 consecutive months, plants, buildings, structures, stockpiles, and equipment must be removed and the property must be restored to a safe and usable condition.

The restoration requirements of the cities and counties canvassed are varied. All that have ordinances, with the exception of Stafford County, require the producer to submit a plan of restoration prior to beginning operations. Only Fairfax County and the cities of Chesapeake and Virginia Beach require the simultaneous restoration of mined areas. Chesterfield, Henrico, and Prince George counties and the cities of Hampton and Newport News require the restoration of extraction sites before the producer abandons the property.

The cities of Chesapeake and Virginia Beach require those applying for use permits for the extraction of sand and gravel to submit a plan consisting of three parts: (1) a general plan as an overlay for an aerial photograph of the area under consideration, (2) a restoration contour plat, and (3) a description of restoration methods and materials proposed for the renewal of topsoil and replanting. These cities require, as a part of restoration plans, that the producer restore grades (no slopes around excavated area permitted to be greater than 1 foot vertical to 3 feet horizontal), replace topsoil (4 inches of topsoil required on all areas not inundated), and replant (15 pounds of fescue-type seed per acre, dressed with 400 pounds of 8-8-8 fertilizer and 2 tons of lime per acre). To assure restoration of mined areas in accordance with prescribed specifications, the companies pay the city of Chesapeake \$0.05 per cubic yard of material produced, and the city of Virginia Beach \$0.02 per cubic yard, in addition to any license, tax, or fee involved in the extraction of the resource. Chesapeake requires the applicant to file a performance bond of \$1000 per acre, or part thereof, and Virginia Beach requires a performance bond of \$500 per acre, or part thereof.

The counties of Chesterfield, Henrico, and Prince George require applicants for use permits to submit a plan of operation that provides for restoring the land to a safe and usable condition, so as to reduce the peaks and depressions, minimize erosion, and conform in general to the land area immediately surrounding the site. All three counties require the applicant to post a bond or other suitable guarantee (no specific amount).

The cities of Hampton and Newport News require the company applying for a use permit to submit a topographic map illustrating, among other features, the depth of cut, the proposed method of drainage of the excavated site, and the general condition and elevation of the land area after termination of operations. The code stipulates that excavated sites be left a clean, smooth, even, plane surface. Hampton requires the applicant to file a performance bond of no less than 10 times the existing market value of the property to be restored, and Newport News requires a bond of no less than 10 times the assessed value of the property, and in no case less than \$500 or more than 30 times the assessed value of the property.

Of the cities and counties reviewed, Fairfax County was found to have the most comprehensive

requirements for the extraction of sand and gravel and the restoration of extraction sites. The following items must accompany an application for a permit to extract sand and gravel: (1) a vertical aerial photograph showing all land requested in the petition, all contiguous land within 1000 feet of land to be mined, and all public roads that provide first point of access; (2) an identification plat showing, among other things, the boundary of the entire tract, limits and current field topography, average thickness of overburden in areas of proposed operations, and means of vehicular access to the proposed operation; (3) sectional maps showing the existing zoning classification of the land area surrounding the proposed site of operations; (4) an operations plan, presented as a transparent overlay to the required aerial photograph, showing the area of active excavation, the area requested for excavation, and several other areas, if any, used or requested for settling ponds, washing, treatment, storage, and production facilities, and resource-related industries (see Fairfax County Zoning Ordinance); (5) a restoration contour plat, indicating the general grades and slopes to which excavation areas are to be backfilled; (6) a restoration plan that provides for continuing restoration, the prevention of soil erosion, and grading, fertilizing, and planting; and (7) a description of the methods and materials to be used for restoration of topsoil to the required fertility and the amount and type of replanting to be done. All banks are required to be left at a slope no greater than 1 foot vertical to 2 feet horizontal. The producer is required to replace 4 inches of topsoil that contains a minimum of 15 percent organic material on graded areas. Upon replacement of the topsoil, the producer is required to plant a ground cover in accordance with instructions from the Fairfax County soil scientist.

Producers in Fairfax County are required to secure a performance bond of \$1000 to \$2000 per acre depending on zonation of the area in which mining is to take place. The restoration is subject to field inspection and aerial review and approval at the midpoint and at the end of each permit period. The Fairfax County ordinance implies that the sand and gravel deposits within its land area are an unrenovable natural resource necessary and beneficial to the economy of the county and welfare of its citizens, and has certain provisions for setting aside natural-resource areas that may enable the extraction of sand and gravel prior to residential development.

The previously mentioned ordinances have varying degrees of effectiveness when considered in view of their intent. It is not the purpose of this article to judge the effectiveness or reasonableness of the controls established by any city or county. In some instances, injustices may be created unintentionally for the sand and gravel producer by community planning, and in other instances plans may be inadequate or unenforced. Provisions of an ordinance may be valid in a metropolitan area, yet unreasonable for a small, rural community. Certainly, the problems of planning are not the same in every locality and no single set of regulations can be applied to all. The Policy Declaration of the Chamber of Commerce of the United States for 1962-63 cautions that: "Local and state governments in regulating land use should recognize that mining is a legitimate use which should be protected in planning community development, and any restrictive measures regulating such use should preserve the right to develop mineral deposits when mining is the highest and most beneficial use to which the land may be dedicated."

Governmental groups that are charged with planning and regulating land use should make the prevention of waste or misuse of a community's mineral resources an essential phase of their effort. The economic, legal, social, and geologic problems that an ordinance may create for a community or its mineral producers must be carefully evaluated. Consideration should be given to the economic impact of new regulations upon the small producers as well as the larger, better established ones. Planners should find it good practice to inform mineral producers of any intent to establish or change ordinances that will affect mining. Those engaged in planning should likewise find it helpful to become acquainted with the management personnel of local mineral industries, and to encourage their active participation in land-use planning. In this way a clearer understanding of each other's problems may be established.

In an introductory statement to "Land Use Planning and the Sand and Gravel Producer," published by the National Sand and Gravel Association, Vincent P. Ahearn, Jr. declared: "If the sand and gravel producer expects to operate under reasonable and workable controls, he must participate actively in the formulation and administration of planning law in his community. Only by the combined assistance of all elements in the community can a plan be developed which reflects

foresight and imagination, which is reasonably designed to protect and promote both the interests of the public and of aggregate producers, and which shows a proper regard for private rights not inconsistent with the protection of the health, safety, and welfare of the community."

The mineral producer may contribute, in turn, to the orderly utilization of sand and gravel resources and protect his interests by taking an active part in community planning whenever possible. Virginia producers who have taken such an active role have learned that planning officials recognize their participation. Such participation is especially effective when producers keep abreast of new rehabilitation techniques and ideas for site utilization. Management has become increasingly aware of the desirability of presenting the best possible image of their company and what it is doing for the community, by participation in local affairs and through advertising. A company may enhance its image by taking the initiative in executing a constructive and positive program of land reclamation, rather than by adopting a "wait and see" attitude toward judicial remedy. As a part of such a program, the industry might well bring to the attention of the community the following facts, as mentioned by Kenneth L. Schellie, planning and landscape consultant for the National Sand and Gravel Association in an address at their 46th Annual Convention:

"(1) Sand and gravel deposits have been created by nature rather than by man; these locations are fixed in an absolute sense and are usually limited in number in any given locality.

"(2) Supplies of sand and gravel are limited in an economic sense. Increasingly exacting engineering specifications, urban and suburban sprawl and ill-advised land use planning have sharply limited sand and gravel supplies in many localities, especially in metropolitan areas. Because of the high-volume low-unit value of sand and gravel, the distance over which these materials must be hauled from the plant to the market has a drastic effect upon cost. Since sand and gravel are among the basic construction materials, each additional mile which the producer must go to extract sand and gravel has a substantial effect upon local construction costs.

"(3) Sand and gravel are not renewable resources. Every ton which a producer sells is, in effect, putting him out of business. A sand and gravel extractive operation, therefore, is by its nature a temporary thing. It is shortsighted and

wasteful if land use planning deliberately allows urban or suburban development to take place in areas containing valuable sand and gravel deposits, without first allowing for the removal of the deposits. Because sand and gravel are mineral resources which every community needs to carry out its construction program, the public interest demands the protection of these deposits.

"(4) In many areas such as Denver, Fairfax County, Va., Los Angeles County, California, and Northport, Long Island, the public interest in resource conservation has been recognized in land use planning. The results have been beneficial to the community and the sand and gravel industry. These principles, therefore, are not only good theory, but are practical and effective."

The National Sand and Gravel Association, Silver Spring, Maryland, is leading a continuing effort on behalf of the sand and gravel industry to advance practices of rehabilitation. In September 1963, the association financed a long-range research program to investigate opportunities and methods for rehabilitating depleted sand and gravel sites. Initiated within the Department of

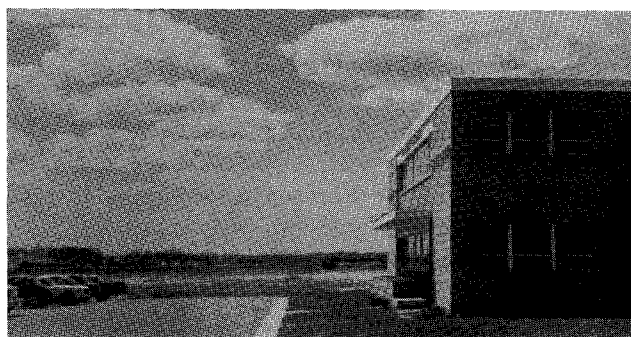


Figure 1. Office building of Virginia Sand and Gravel Company, Inc., at north end of former gravel-removal operation, Fairfax County. (Photograph courtesy of the National Sand and Gravel Association.)

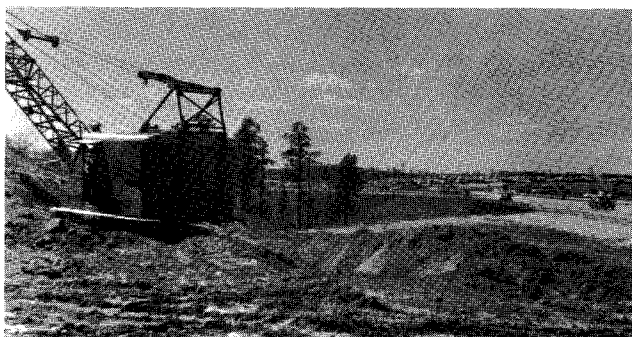


Figure 2. Extraction site, across the highway from area shown in Figure 1, from which sand and gravel are currently being removed. (Photograph courtesy of the National Sand and Gravel Association.)



Figure 3. Industrial plant built on reclaimed sand and gravel extraction site in Fairfax County. (Photograph courtesy of the National Sand and Gravel Association.)

Landscape Architecture at the University of Illinois, the program provides a research assistantship to a graduate student of landscape architecture. Two reports have been published under the program.

One report, "Simultaneous Excavation and Rehabilitation of Sand and Gravel Sites" (Research Project No. 1, 1963-64), by Anthony M. Bauer, focuses upon general factors and procedures of the sand and gravel operations which must be considered in preplanning for eventual development of the site for home sites, industrial or recreational areas, etc. An accompanying case study illustrates how these factors and procedures could be implemented in actual practice. Another report, "Practical Operating Procedures for Progressive Rehabilitation of Sand and Gravel Sites" (Research Project No. 2, 1964-65), by Craig W. Johnson, identifies and analyzes significant operational factors of typical sites. Special attention is placed upon equipment, its use and capabilities, and procedures that would affect site development for various potential land uses. An accompanying case study illustrates how equipment operations could be preplanned and implemented on an actual site.

A third study, "Site Rehabilitation — Final Land Use Potentials and Requirements for Sand and Gravel Sites" (Research Project No. 3), by David R. Jensen, is in progress. The report will analyze typical features of extraction sites and will show how these features may be incorporated into planning for ultimate use of the areas. Other research projects to be undertaken will study site planning for the operation of sand and gravel excavations, the potential of the sites for recreation and sanitary landfill use, and the revegetation of sites.

On the State level, the Virginia Association of Crushed Stone, Gravel, and Sand Producers, Inc., Richmond, is taking the initiative to meet with planning groups and to inform its member producers of the benefits they can receive by taking an active part in community resource planning. In 1965, 15,322,000 tons of sand and gravel valued at \$18,019,000 were reported produced in Virginia by more than 60 producers. Over four-fifths of the total tonnage and value was obtained in Fairfax County, the city of Virginia Beach, and Chesterfield, Henrico, and Prince George counties, in order of their contributions. More than one-half of the total production (53 percent) of the sand and gravel was utilized for paving, most of which was for public highways. Sand and gravel utilized for various building purposes accounted for 25 percent, and the major portion of the remaining production was marketed for glass sand, engine sand, filtration sand, railroad ballast, and fill material.

Some of the former extraction sites from which these materials were obtained have been reclaimed for a variety of useful purposes. The sites are now occupied by industries, schools, high-rise apartments, and residential subdivisions, with a resulting rise in assessed valuations of the properties and increased tax revenue. Some former sites, now water-filled, have been developed as desirable lake-front residential properties. Other sites have had a multiple-use role, serving first as a source of sand and gravel, and subsequently being used as disposal areas for refuse in carefully planned sanitary-landfill operations. After completion of the sanitary-landfill operation, the tracts have been developed as properties for commercial and other building. In many instances, land which formerly had little value or was unsuitable for development because of irregular topography or poor drainage has been improved and made useful.

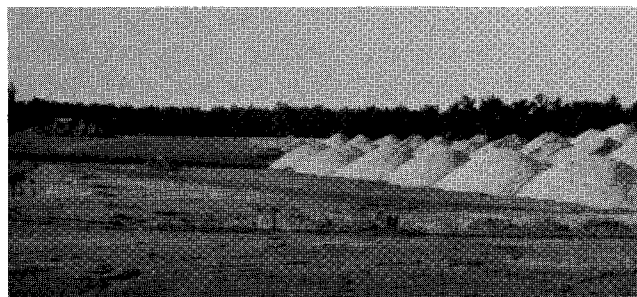


Figure 4. Sand and gravel extraction site in Chesterfield County during process of reclamation. (Photograph courtesy of the Virginia Association of Crushed Stone, Gravel, and Sand Producers, Inc.)



Figure 5. Topsoil being placed on reclaimed extraction site shown in Figure 4. (Photograph courtesy of the Virginia Association of Crushed Stone, Gravel, and Sand Producers, Inc.)

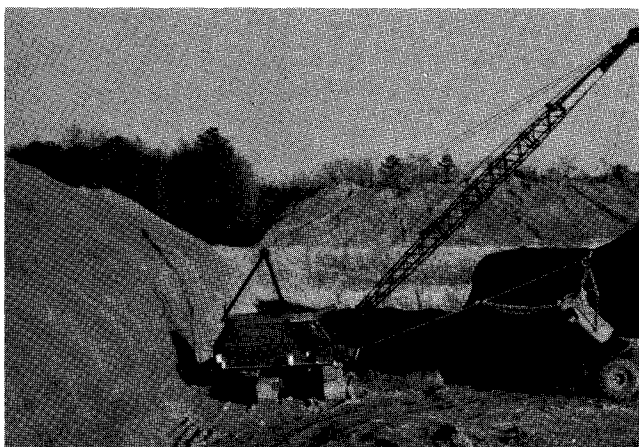


Figure 6. Steep banks and windrows of overburden at extraction site in Henrico County. (Photograph courtesy of the Virginia Association of Crushed Stone, Gravel, and Sand Producers, Inc.)

The Virginia Sand and Gravel Company, Inc., of Springfield, and Southern Materials Company, Inc., with headquarters at Norfolk, have been outstanding in their reclamation efforts. The former company was the largest producer of sand and gravel in Fairfax County in 1965 and currently operates five extraction sites and four processing plants in the county. The company, which has taken an active part in community planning, has reclaimed many acres of land from which they have removed the sand and gravel. Their modern office building located near the intersection of Edsall Road and Shirley Highway is at the northern end of a gravel-removal operation (Figure 1). Before the land was reclaimed, large ravines up to 60 feet in depth were present. Across Shirley Highway from this reclaimed extraction area is a similar area from which sand and gravel are being removed (Figure 2) which illustrates the nature of the terrain before reclamation. Industries have located their plants at

the sites of two of the company's former operations along Shirley Highway near Edsall Road. The industrial plant shown in Figure 3 is located on land that was reclaimed after the sand and gravel were removed. The extraction area, where the plant is now located, was filled and graded with ordinary overburden in order to sustain the weight of the buildings. The gravel-extraction site now provides attractive landscaping and a parking area. The industrial complex occupies land that rose in assessed value from \$50,000 in 1955 to \$775,000 in 1960.

Southern Materials Company, Inc., Norfolk, produces a large volume of sand and gravel in the vicinity of Richmond. The company currently extracts material from six locations in the Richmond area, including four sites in Henrico County, one site in Chesterfield County, and one site in Charles City County. In many instances the company has exceeded restoration requirements stipulated in local ordinances. Figure 4 illustrates an extraction site in Chesterfield County as it appeared during the process of reclamation. After backfilling and leveling, topsoil was replaced (Figure 5). At one locality north of the James River at Curles Neck, Henrico County, a large tract of swamp was reclaimed during extraction and the area is now used, in part, for farming. Additional lands suitable for farming have been developed by the company at other sites. Other restoration work in Henrico County is illustrated in Figures 6, 7, and 8, which show several stages of development. The banks resulting from extraction (Figure 6) were sloped (Figure 7), topsoil was replaced (Figure 8), and the area below the topsoiled banks was later filled with water, creating a potential lake-front property.



Figure 7. Stage in the reclamation of site shown in Figure 6. Area in foreground has been sloped and topsoiled; the area in back has not. (Photograph courtesy of the Virginia Association of Crushed Stone, Gravel, and Sand Producers, Inc.)

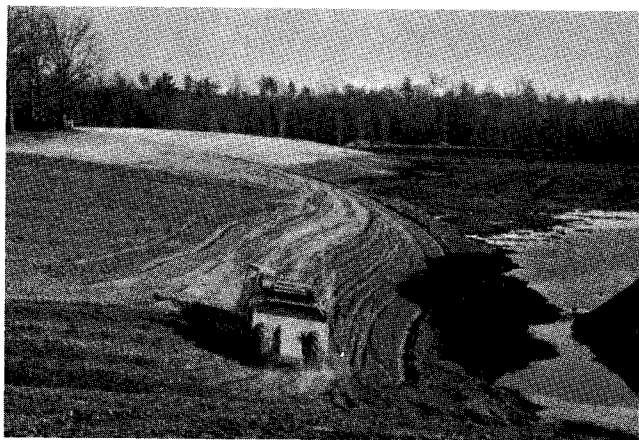


Figure 8. Topsoil being placed on sloped banks of extraction site shown in Figure 6. Area below topsoiled slope will be filled with water to create a small lake. (Photograph courtesy of the Virginia Association of Crushed Stone, Gravel, and Sand Producers, Inc.)

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NEW PUBLICATIONS

Bulletin 81. GEOLOGY AND MINERAL RESOURCES OF PAGE COUNTY, by Rhesa M. Allen, Jr.; 78 p., 1 map in color. Price: \$3.25

Page County is located in the northwestern part of Virginia in the Blue Ridge and Valley and Ridge physiographic provinces. Its boundaries enclose an area of 316 square miles which extends from the crest of the Blue Ridge on the east to Massanutten Mountain on the west. The South Fork of the Shenandoah River, the major stream, passes through the central part of the county. Bedrock in the county consists of Precambrian to Devonian rocks, with one known occurrence of Triassic igneous rock. Quaternary terrace gravels cover much of the bedrock in the central part of the county, and river flood-plain alluvium is present along the margins of the South Fork and its major tributaries and in scattered places on the upland surface of the valley.

The major structures in the Page County area include from east to west: the western flank of the Blue Ridge-Catoctin Mountain anticlinorium, the faulted and intensely folded anticlinal structure of the central part of the county, and the synclinal complex of the Massanutten Mountain area. The Cambrian and Ordovician rocks in Page Valley form a large fold overturned to the northwest. The Massanutten Mountain region, comprising Ordovician, Silurian, and Devonian rock, has been deformed into a synclinorium. A major fault structure in the area, the north-northeast

trending Stanley fault, appears to have essentially vertical movement with the east-southeast side upthrown. In the northern part of the county the Vaughn fault zone consists of several closely spaced thrust faults that border the west front of the Blue Ridge.

The mineral resources of Page County that are of current or potential interest consist of the gneissic and granitoid rocks and greenstone that can be used for construction purposes, the carbonate rocks, sand and gravel, quartzose rocks, and clays. The copper ores of the Blue Ridge have been worked in the past but appear to be of poor quality and limited quantity. Iron and manganese ores were mined, milled, and smelted in the past, especially in the area east of the town of Shenandoah. Surface water is plentiful, and generally sufficient quantities of ground water are available for present needs.

Report of Investigations 12. GEOLOGY OF THE STAUNTON, CHURCHVILLE, GREENVILLE, AND STUARTS DRAFT QUADRANGLES, VIRGINIA, by Eugene K. Rader; 43 p., 4 maps in color. Price: \$4.25

The Staunton, Churchville, Greenville, and Stuarts Draft quadrangles are located in the central part of Augusta County, west-central Virginia. Bedrock in the area ranges in age from Middle Cambrian to Late Devonian, but consists principally of Cambrian and Ordovician rocks. Most of the rocks are sedimentary and have a total thickness of approximately 20,000 feet. Igneous rocks in the area (dikes, plugs, and sills) are of four general compositions: diabase, nepheline syenite, teschenite syenite, and teschenitepicrite. Generally the dikes are poorly exposed and are less than 50 feet thick.

Structurally, the eastern part of the area has folds and minor thrust faults in the Massanutten synclinorium. Northwest of the synclinorium, the Pulaski-Staunton fault transects the area in a northeasterly direction. This thrust fault is folded conformably with the Middlebrook anticline and a branch of the Long Glade syncline. Roughly parallel to, and northwest of the Pulaski-Staunton fault is another thrust fault, the North Mountain fault, which is on the southeast side of Little North Mountain. Little North Mountain consists of overturned steeply dipping Silurian and Devonian rocks. Northwest of Little North Mountain is a portion of a broad syncline containing Upper Devonian rocks.

The mineral resources in the area consist of limestone, dolomite, shale, bauxite, and iron oxide. Limestone and dolomite used as crushed stone and agricultural stone are quarried from rocks of Cambrian and Ordovician ages. Shales of the Edinburg and Brallier formations and some residual clays have been tested for potential use in the manufacture of brick and ceramic products. Bauxite has been produced from residuum west of Greenville. Iron oxide has been produced from the lower portion of the Beekmantown Formation. Adequate domestic water supplies can be obtained in most areas, and abundant water supplies may occur in the vicinity of South River.

Information Circular 13. DIRECTORY OF THE MINERAL INDUSTRY IN VIRGINIA — 1967, by D. C. Le Van; 45 p. Price: \$0.25

This directory lists 253 companies and individuals on record as of March 15, 1967. The listing includes portable crushing plants, some captive and intermittent operations, and some processors of out-of-State or imported materials. The names of producers and processors are arranged by raw material or commodity under the appropriate county or city. The locations of the various operations, are given with respect to a nearby city or town. An alphabetical listing of the names of companies and individuals is provided as a reference index.

GEOGRAPHIC NAMES IN VIRGINIA

It is the purpose of the United States Board on Geographic Names to render formal decisions on new names, proposed changes in names, and names that are in conflict which are submitted for decision by individuals, private organizations, or government agencies. Communications about these names should be addressed to: J. O. Kilmarlin, Executive Secretary, Domestic Geographic Names, U.S. Geological Survey, Washington, D.C. 20242.

An asterisk (*) preceding a name represents a change in an earlier decision; a dagger (†) preceding a name indicates modification of the text of a former decision.

Bens Run: stream, 3.5 miles long, heads on Potts Mountain, at 37°39'27" N., 80°02'57" W., flows north-northwest to Potts Creek 12.5 miles north of New Castle; Alleghany County, Virginia; 37°41'17" N., 80°05'17" W., Not: Bens Branch.

Bentley Branch: stream, 3 miles long, heads at 37°07'22" N., 80°48'40" W., flows south to Tract Fork 3 miles north-northwest of Pulaski; Pulaski County, Virginia; 37°05'15" N., 80°48'25" W. Not: Bentleys Branch.

Big Hellgate Creek: stream, 3 miles long, heads at 37°35'10" N., 79°27'40" W., flows north-west to the James River 11 miles southwest of Buena Vista; Rockbridge County, Virginia; 37°36'51" N., 79°29'20" W. Not: Hellgate Creek, Little Hellgate Creek.

Big North Mountain: mountain ridge, trends northeast-southwest for 50 miles; its northeast end is 1.5 miles east of Gore, Virginia, and its southwest end is 3.5 miles southwest of the settlement of Orkney Springs, Virginia; Virginia-West Virginia; 39°15'45" N., 78°18'15" W. (northeast end), 38°45'45" N., 78°52'15" W. (southwest end). Not: Greater North Mountain, Greater North Mountains, Great North Mountain, North Mountain, North Mountains.

Big Otter River: stream, 45 miles long, heads at 37°23'53" N., 79°39'33" W., flows east-southeast to the Roanoke River 2.5 miles northeast of Altavista; Bedford and Campbell counties, Virginia; 37°07'55" N., 79°15'08" W. Not: Big Otter Creek, Otter River.

Big Rocky Run: stream, 8 miles long, heads at 38°51'35" N., 77°22'05" W., flows southwest

to Cub Run 5 miles north of Manassas; Fairfax County, Virginia; 38°49'41" N., 77°27'39" W. Not: Rocky Run.

Big Shuffle Branch: stream, 2.5 miles long, heads at 37°06'25" N., 80°51'45" W., flows southeast to Tract Fork 4 miles northwest of Pulaski; 37°05'06" N., 80°49'53" W. Not: Kent Branch, Lick Branch.

Blue Spring Run: stream, 9 miles long, heads on Rich Patch Mountains, at 37°41'50" N., 79°56'50" W., flows west-northwest to Potts Creek 15 miles north-northeast of New Castle; Alleghany County, Virginia; 37°43'17" N., 80°02'47" W. Not: Blue Spring Creek.

Boiling Spring: community, along Potts Creek, 12.5 miles north of New Castle; Alleghany County, Virginia; 37°41'20" N., 80°05'30" W. Not: Arritt, Arritts, Boiling Springs.

Brushy Ridge: ridge, trends northeast-southwest 10 miles, 3 miles north of Max Meadows and 5 miles west of Pulaski; Wythe County, Virginia; 36°59'40" N., 81°01'20" W., (southwest end), 37°02'35" N., 80°51'55" W. (northeast end). Not: Brushy Mountain, Little Brush Mountain, Little Brushy Mountain.

Chamberlayne Point: point of land, in the Pamunkey River 25 miles east of Richmond; New Kent County, Virginia; 37°34'45" N., 76°59'30" W. Not: Chamberlain Point, Chamberlin Point.

Charlemont: community, 2.5 miles southeast of Sedalia and 14 miles northwest of Lynchburg; Bedford County, Virginia; 37°28'00" N., 79°24'25" W. Not: Charleymont.

Childress Branch: stream, 0.8 mile long, flows east to the South Fork Piney River 11 miles northeast of Buena Vista; Amherst County, Virginia; 37°46'51" N., 79°09'55" W. Not: Chillas Branch.

Christian: settlement, 4.5 miles southwest of Churchville and 8.5 miles west-northwest of Staunton; Augusta County, Virginia; 38°10'50" N., 79°13'40" W. Not: Christians.

Christleys Run: stream, 4 miles long, heads on Potts Mountain, at 37°37'50" N., 80°06'18" W., flows north to Potts Creek 12 miles north of New Castle; Alleghany County, Virginia;

37°40'40" N., 80°05'48" W. Not: Chesley Run, Chisley Run, Chisleys Run, Christleys Branch, Chrystleys Run, Crysteleys Run.

Church Mountain: mountain ridge, 7 miles long, trends north-northeast from Fulks Run to the Virginia-West Virginia boundary where the ridge divides to become Cove Mountain and Big North Mountain; Rockingham County, Virginia; 38°45'45" N., 78°52'15" W. (north end), 38°41'30" N., 78°54'20" W. (south end).

Clear Brook: settlement, 6 miles northeast of Winchester; Frederick County, Virginia; 39°15'25" N., 78°05'40" W. Not: Clearbrook.

† *Cobham Bay*: bend, 3 miles wide, in the estuary of the James River 4 miles southeast of Jamestown; Surry County, Virginia; 37°09'30" N., 76°44'00" W. (center). Not: Chip-oaks Bay, Chippoaks Bay, Chippokes Bay.

Cohoke Millpond: reservoir, 1.5 miles long, 9 miles west-northwest of West Point and 28 miles east of Richmond; King William County, Virginia; 37°34'50" N., 76°56'48" W. (at dam). Not: Cohoke Mill Pond, Cohoke Pond.

Cousiac Marsh: marsh, 2 miles long and 1 mile wide, on the south side of the Pamunkey River 6.5 miles northwest of West Point; New Kent County, Virginia; 37°33'35" N., 76°55'30" W. Not: Cousaia Marsh, Cousaic Marsh, Cowsic Marsh.

East Wilderness Creek: stream, 5 miles long, heads at 37°13'35" N., 81°01'20" W., flows south-southeast to Kimberling Creek 15 miles east-southeast of Bluefield, West Virginia; Bland County, Virginia; 37°10'52" N., 80°58'38" W. Not: North Fork Kimberling Creek, Wilderness Creek.

* *Elliott Creek*: stream, 13 miles long, heads on Pilot Mountain at 37°03'00" N., 80°24'35" W., flows east-northeast to the South Fork Roanoke River at the settlement of Alleghany Springs; Montgomery County, Virginia; 37°07'37" N., 80°16'00" W. Not: Ellett Creek [former decision].

Falls Hollow: watercourse, 2 miles long, heads at 37°40'12" N., 80°16'02" W., trends east-southeast to Cove Creek 13 miles northwest of New Castle; Alleghany County, Virginia;

37°40'15" N., 80°14'30" W. Not: Fall Hollow Branch.

* *Goulders Creek*: stream, 6 miles long, heads at 37°32'15" N., 76°41'57" W., flows west-southwest to the York River 2 miles southwest of West Point; King and Queen County, Virginia; 37°30'37" N., 76°46'25" W. Not: Golders Creek (former decision), Hokely Creek.

Grahams Forge: settlement, 4 miles southeast of Max Meadows and 11 miles east of Wytheville; Wythe County, Virginia; 36°56'25" N., 80°53'15" W. Not: Graham Forge.

Great North Mountain: mountain ridge, trends northeast-southwest for 20 miles; its northeast end is 12 miles west-northwest of Staunton and its southwest end 14 miles north-northwest of Lexington; Augusta and Rockbridge counties, Virginia; 38°12'40" N., 79°16'30" W. (northeast end), 37°59'30" N., 79°29'30" W. (southwest end). Not: Big North Mountain, Greater North Mountain, North Mountain.

Gwynn: village, on Gwynn Island, 5 miles northeast of Mathews; Mathews County, Virginia; 37°30'15" N., 76°17'15" W.

Gwynn Island: island, 3 miles long and 1.5 miles wide, in the Chesapeake Bay, at the mouth of the Piankatank River 4.5 miles northeast of Mathews; Mathews County, Virginia; 37°30'00" N., 76°17'30" W. Not: Gwynns Island.

Highcock Knob: knob, elevation 3073 feet, 2.5 miles south of the James River and 12 miles south-southwest of Buena Vista; Bedford and Rockbridge counties, Virginia; 37°33'50" N., 79°26'30" W. Not: High Cock, Highcock, High Cock Knob.

Hogan Lake: reservoir, 1 mile long, at the head of Hogan Branch 2.5 miles southwest of Pulaski; Pulaski County, Virginia; 37°01'22" N., 80°48'55" W. (at dam). Not: Pulaski Reservoir.

Jacks Branch: stream, 1.8 miles long, heads at 37°36'03" N., 79°14'43" W., flows southwest to the Pedlar River, 1.5 miles north of Pedlar Mills and 11 miles south-southeast of Buena Vista; Amherst County, Virginia; 37°34'52" N., 79°16'00" W. Not: Jackes Branch, Jakes Branch.

Jordan Mines: community, on Potts Creek, 11 miles north of New Castle; Alleghany County, Virginia; 37°39'40" N., 80°07'00" W.

Kent Branch: stream, 3 miles long, heads at 37°06'28" N., 80°51'20" W., flows southeast to Tract Fork 3.5 miles northwest of Pulaski; Pulaski County, Virginia; 37°05'15" N., 80°45'55" W. Not: Big Shuffle Branch.

* *Lambs Creek*: stream, 4 miles long, heads at 38°17'45" N., 77°16'33" W., flows south-southeast to the Rappahannock River 4.5 miles southeast of Passapatanzy; King George County, Virginia; 38°15'05" N., 77°15'32" W. Not: Lamb Creek [former decision].

Little Hellgate Creek: stream, 2.3 miles long, heads at 37°35'27" N., 79°27'56" W., flows west-northwest to Elk Creek in Arnold Valley, 12 miles southwest of Buena Vista; Rockbridge County, Virginia; 37°36'06" N., 79°30'06" W. Not: Hellgate Creek.

Little North Mountain: mountain ridge, trends northeast-southwest for 24 miles, in the Appalachian Mountains; its northeast end is 9 miles west-northwest of Staunton and its southwest end 10 miles north of Lexington; Augusta and Rockbridge counties, Virginia;

38°12'40" N., 79°13'40" W. (northeast end), 37°56'00" N., 79°27'30" W. (southwest end). Not: Brown Hill, North Mountain.

Little North Mountain: mountain ridge, trends southwest for 34 miles from the settlement of Cedar Grove to Stultz Gap, 6.5 miles west-northwest of Woodstock; Frederick and Shenandoah counties, Virginia; 39°15'50" N., 78°11'15" W. (northeast end), 38°54'50" N., 78°37'00" W. (southwest end). Not: Little North Mountains.

Little Otter River: stream, 25 miles long, heads on Cobbs Mountain, at 37°22'35" N., 79°36'32" W., flows southeast to the Big Otter River 7 miles southeast of Bedford; Bedford County, Virginia; 37°16'30" N., 79°24'20" W. Not: Little Otter Creek, Otter River, North Fork Little Otter Creek.

Locust Hill: settlement, 2 miles east-southeast of Max Meadows and 10 miles east of Wytheville; Wythe County, Virginia; 36°57'30" N., 80°54'55" W. Not: Poletown.

* *Looney Creek*: stream, 2.5 miles long, heads at the confluence of Back Creek and Mill Creek, at 37°29'53" N., 79°43'48" W., flows northeast to the James River 1.4 miles southwest of Buchanan; Botetourt County, Virginia; 37°31'05" N., 79°42'10" W. Not: Back Creek, Looney Mill Creek [former decision], Looneys Mill Creek.

McKittricks Branch: stream, 4.5 miles long, heads at 38°14'40" N., 79°15'42" W., flows east to Jennings Branch 9 miles northwest of Staunton; Augusta County, Virginia; 38°14'50" N., 79°10'57" W. Not: McKittrick Branch, South Fork McKittricks Branch.

Mill Branch: stream, 4 miles long, heads at the junction of Toms Branch and an unnamed stream at 37°37'34" N., 80°09'14" W., flows northeast to Potts Creek 11 miles north of New Castle; Alleghany County, Virginia; 37°39'55" N., 80°07'05" W. Not: Mill Run.

* *Mill Creek*: stream, 12 miles long, heads just northwest of Troutville, flows northeast to join Back Creek to form Looney Creek 3.3 miles southwest of Buchanan; Botetourt County, Virginia; 37°29'53" N., 79°43'48" W. Not: Looney Mill Creek [former decision], Looneys Mill Creek.

Nininger Creek: stream, 9 miles long, heads at 37°17'10" N., 79°32'40" W., flows east to the Little Otter River 5.5 miles southeast of Bedford; Bedford County, Virginia; 37°16'57" N., 79°26'25" W. Not: Peddler Creek, Pedlar Creek, Pedlars Creek.

North Mountain: mountain ridge, trends northeast-southwest for 18 miles; its northeast end is 11 miles west-northwest of Lexington and its southwest end 11 miles south-southeast of Clifton Forge; Alleghany, Botetourt, and Rockbridge counties, Virginia; 37°53'30" N., 79°35'00" W. (northeast end), 37°44'30" N., 79°44'30" W. (southwest end). Not: Big Hill, Longdale Mountain, North Mountains.

North Otter Creek: stream, 10 miles long, heads at the confluence of Gunstock and Overstreet creeks, at 37°28'35" N., 79°29'03" W., flows south-southeast to the Big Otter River 15 miles west of Lynchburg; Bedford County, Virginia; 37°23'05" N., 79°26'42" W. Not: North Fork Big Otter River, North Fork Otter, North Fork Otter River.

Pera: settlement, 8 miles south-southeast of Buena Vista and 9 miles east of Glasgow; Amherst County, Virginia; 37°37'00" N., 79°17'30" W. Not: Peru.

* *Popcastle Creek*: stream, 3 miles long, heads at 38°17'35" N., 77°14'17" W., flows south-southwest to Lambs Creek 4 miles southeast of Passapatanzy; King George County, Virginia; 38°15'37" N., 77°15'36" W. Not: Popcastle Run [former decision].

Renick Run: stream, 5 miles long, heads at 37°37'08" N., 79°39'10" W., flows south-southeast to the James River at Indian Rock 3.5 miles northeast of Buchanan; Botetourt County, Virginia; 37°33'49" N., 79°38'04" W. Not: Rocky Run.

† *Robertson Mountain*: mountain, elevation 3261 feet, in Shenandoah National Park, 2 miles northwest of Old Rag Mountain and 9 miles southeast of Luray; Madison County, Virginia; 38°34'13" N., 78°20'35" W. Not: Haywood Mountain.

† *Rose River*: stream, 9 miles long, heads in Shenandoah National Park on the slopes of Hawksbill, at 38°33'05" N., 78°24'12" W., flows southeast to the Robinson River 1.3 miles north-northwest of Criglersville and 7 miles north-northwest of Madison; Madison County, Virginia; 38°28'23" N., 78°18'55" W. Not: Robertson River.

Shenandoah Mountain: mountain ridge, trends northeast-southwest for 73 miles, in the Appalachian Mountains, 15 miles west of Harrisonburg, Virginia; it is bounded on the west by the Cowpasture and South Fork South Branch Potomac rivers and on the east by Stuart Run and the Calpasture River; Virginia-West Virginia; 38°55'00" N., 78°55'30" W. (northeast end), 38°00'00" N., 79°37'30" W. (southwest end). Not: Great North Mountain, Pendelton Mountain, Shenandoah Mountains.

Skinells Creek: stream, 4.5 miles long, heads at 37°18'38" N., 79°31'30" W., flows southeast to Nininger Creek 4 miles southeast of Bedford; Bedford County, Virginia; 37°16'26" N., 79°28'13" W. Not: Echols Creek.

Sugartree Branch: stream, 1.5 miles long, flows north to the Saint Marys River 4.5 miles east-northeast of Vesuvius; Augusta County, Virginia; 37°55'35" N., 79°06'58" W. Not: Sugarcamp Branch.

* *Swans Gut Creek*: stream, 3.5 miles long, heads in Maryland at Big Millpond, flows south-southeast, into Virginia, to Chincoteague Bay 4.5 miles north-northwest of Chincoteague; Worcester County, Maryland, and Accomack County, Virginia; 37°59'15" N., 75°25'45" W. Not: Swan Creek, Swan Cut, Swan Gut, Swan Gut Creek, Swanscut Creek (former decision), Swanscutt Creek, Swansecute Creek.

Trout Dale: town, on south side of Iron Mountains, 10 miles south-southeast of Marion; Grayson County, Virginia; 36°42'08" N., 81°26'39" W. Not: Troutdale.

Turkey Pen Ridge: ridge, 1.5 miles long, 2.5 miles southwest of Sherando and 25 miles northeast of Lexington; Augusta County, Virginia; 37°57'00" N., 79°00'00" W. Not: Turkey Ridge.

Wilderness Creek: stream, 4 miles long, heads at 37°13'30" N., 81°01'50" W., flows west-southwest to Wolf Creek 8 miles east-southeast of Bluefield, West Virginia; Bland County, Virginia; 37°12'58" N., 81°05'35" W.

Wilson Creek: stream, 14 miles long, heads at 36°39'50" N., 81°29'25" W., flows southeast to the New River at Mouth of Wilson, 20 miles south-southeast of Marion; Grayson County, Virginia; 36°35'03" N., 81°19'45" W. Not: Big Wilson Creek.

NEWS NOTES

A new coal transloading facility has been put into operation at Appalachia, Wise County, by the General Coal Company. This facility enables several of the mines in the area to combine production in order to take advantage of unit-train shipment to market. The coal is transported from the mines to the transloader, rotary dumped, and stored in concrete silos for reloading as needed into 6000 and 10,000 ton unit trains. At present the transloader has three silos, each 70 feet in diameter, 180 feet high, and having a capacity of about 14,000 tons. The coal is loaded into the silos by a conveyor system that has a capacity of 3000 tons per hour. A conveyor system capable of moving 4000 tons per hour carries the coal from the silos into a 200-ton surge bin, from which the railroad cars are loaded. Identical three-stage sampling systems maintain a check on both incoming and outgoing coal.

The first shipment was made from the transloader on September 19, 1966, and one unit train has been loaded daily since that time. The trains move on definite schedules via the Southern Railway to the consumers. The transloader is now operating at about 3,000,000 tons annually, and will have an ultimate capacity of about 6,000,000 tons annually, with the addition of four more silos.

The operations of W. S. Frey Company, Inc., near Clear Brook, Frederick County, have been expanded to include the manufacture of lime. A 160-foot, coal-fired rotary kiln was placed in service for this purpose in December 1966. The company has quarried the New Market Limestone at this site since 1961 and began underground mining of the limestone in 1964. In addition to lime, company products include fluxstone, roadstone, agstone, and other crushed-stone materials.

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ADDITION TO STAFF

Mr. Robert G. Willson joined the Division on July 3, 1967. He received a B.S. degree in geology from Allegheny College in 1965 and an M.S. degree in geology from the University of North Dakota in 1967 where he specialized in ground-water studies. Mr. Willson was employed as a geologist by the North Dakota State Geological Survey during 1966. He is married and has two daughters.

HISTORIC ITEMS

The following notes are taken from "Boundaries of the United States and the Several States," U. S. Geological Survey Bulletin 1212.

At one time, Virginia stretched from the Atlantic to the Pacific. A charter in 1609 gave Virginia a strip of land bordering on the Atlantic Coast for 200 miles northward from Point Comfort, and for the same distance southward, and extending inland west and northwest to the sea. Thus, Virginia claimed a total area of more than 1 million square miles following this charter.

Reductions in Virginia area were made by the charters to Maryland in 1632 and to Pennsylvania in 1681. The Connecticut charter in 1662 practically made the parallel of 41° the northern boundary. The charters of Carolina in 1663 and 1665 changed the southern boundary to its present statute position. The area of Virginia was still further reduced by the French treaty of 1763, which made the Mississippi River the west boundary; by the cession to the United States of the territory northwest of the Ohio River in 1784; by the admission of Kentucky as an independent Commonwealth in 1792; by the division in 1863 when the new State of West Virginia was created and admitted to the Union; and finally, by the transfer of two counties to West Virginia in 1866.

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PROGRESS OF TOPOGRAPHIC MAPPING

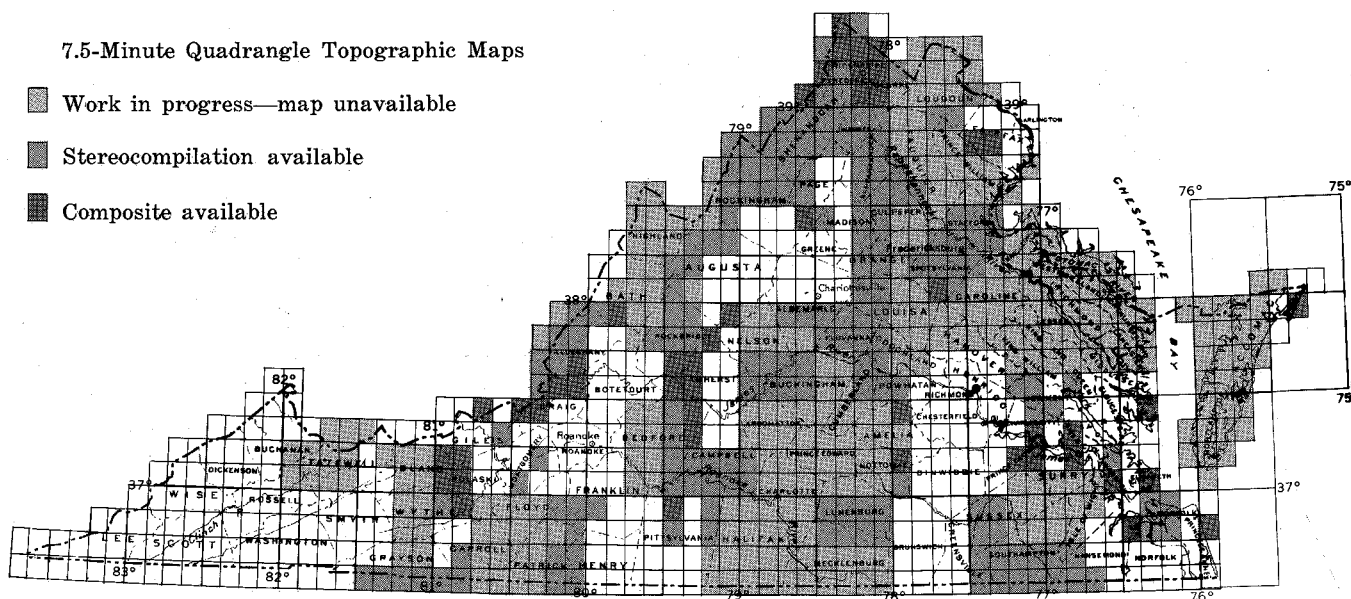
The following statistical compilation and status maps indicate the progress of the 7.5-minute quadrangle topographic mapping program in Virginia through June 30, 1967:

	Number of 7.5-minute Quadrangles	Percent of State
Total number	807	100
Mapping in progress	505	63
Recent aerial photography	709	88
Stereocompilations	165	20
Composites	49	6
Modern maps published from 7/1/66 to 6/30/67	98	12
Modern maps published	302	37
Total number of stereo- compilations, composites, and published maps	516	64

TOPOGRAPHIC MAPS IN PROGRESS

7.5-Minute Quadrangle Topographic Maps



-  Work in progress—map unavailable
-  Stereocompilation available
-  Composite available



Shaded areas represent 7.5-minute quadrangles where topographic mapping was in progress as of June 30, 1967. Stereocompilations are advance maps that show topography, drainage, and buildings; they have no cultural names and have not been field checked. Composites are advance maps that show topography, drainage, buildings, and cultural names and have been field checked. Blue-line prints of advance maps are available at 50 cents each from the U.S. Geological Survey, Topographic Division, 1109 N. Highland St., Arlington, VA 22210.

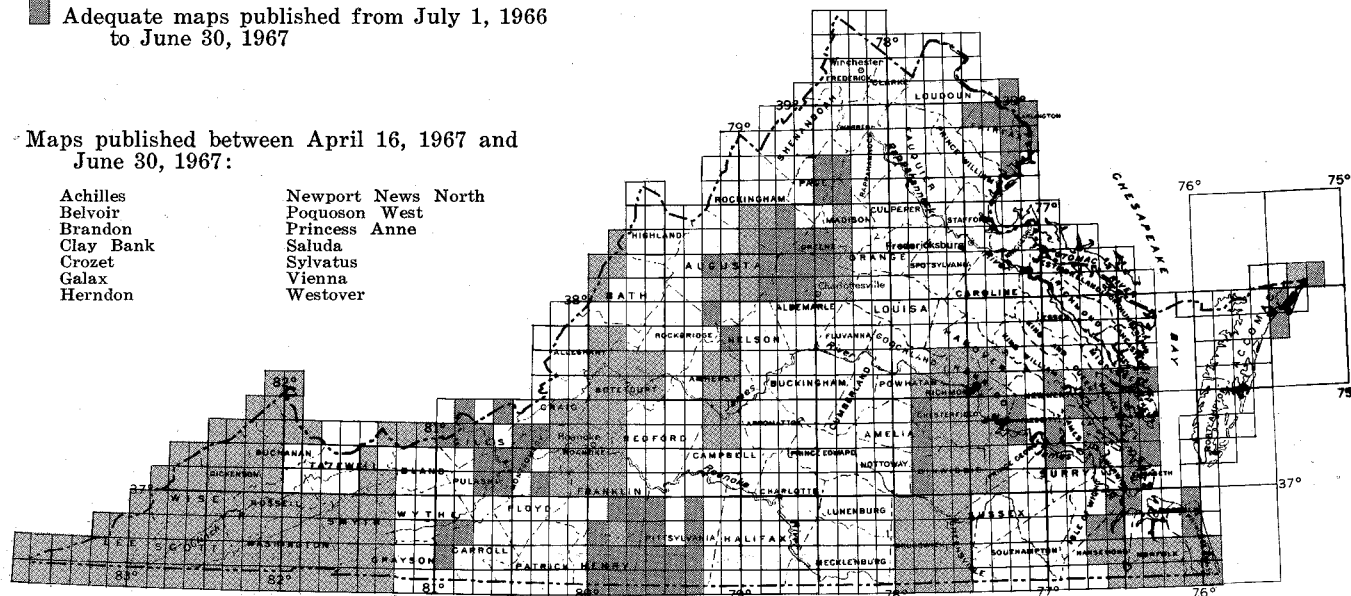
PUBLISHED TOPOGRAPHIC MAPS

7.5-Minute Quadrangle Topographic Maps

-  Adequate maps available prior to July 1, 1966
-  Adequate maps published from July 1, 1966 to June 30, 1967

Maps published between April 16, 1967 and June 30, 1967:

Achilles	Newport News North
Belvoir	Poquoson West
Brandon	Princess Anne
Clay Bank	Saluda
Crozet	Sylvatus
Galax	Vienna
Herndon	Westover



Shaded areas represent 7.5-minute quadrangles where maps that conform to modern topographic standards are available. These published maps may be obtained at 50 cents each from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, VA 22903. A State index to topographic maps is available free.

Charlottesville, VA 22903

Return Requested

Shaded areas represent recent (since 1958) aerial-photograph coverage. Information concerning aerial photography may be obtained from the U.S. Geological Survey, Map Information Office, Washington, DC 20242.